REMARKS

In accordance with the foregoing, claims 1, 14, 15, and 17 are amended. Claims 29-32 are added. No new matter is added. Claims 1, 3, 6-9, and 12-32 are pending and under consideration.

CLAIM REJECTIONS UNDER 35 USC § 112

Claims 1, 3, 6-9, and 12-28 are rejected under 35 U.S.C. §112, first paragraph, related to the term "idler light." The independent claims are amended herewith according to the Examiner's suggestion, by removing the limitation using this term from the claims. In view of the claim amendments, Applicant respectfully requests that the rejections under 35 U.S.C. §112 be withdrawn.

CLAIM REJECTIONS UNDER 35 USC § 103

Claims 1, 3, 6, 8, 9, 12-17 are rejected under 35 USC 103(a) as allegedly being unpatentable over the article "All-optical fiber signal processing and regeneration for soliton communications" to Bigo et al. (hereinafter "Bigo"), "Optical Networks: A Practical Perspective" to Ramawaswami et al. ("Ramaswami"), U.S. Patent No. 5,548,433 to Smith et al. ("Smith") and U.S. Patent No. 5,596,667 to Watanabe ("Watanabe"). Claims 7 and 18 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Bigo, Ramaswami, Smith, and Watanabe in further view of "Simultaneous wavelength conversion and optical phase conjugation of 200 Gb/s (5x40 Gb/s) WDM signal using a highly nonlinear fiber four-wave mixer" by Watanabe et al. ("Watanabe 9/97"). Claims 19-28 are rejected under 35 U.S.C. §103(a) as allegedly being unpatentable over Bigo, Ramaswami, Smith, and Watanabe in further view of U.S. Patent No. 6,307,984 to Watanabe et al. (corresponding to WO98/08138, hereinafter "Watanabe WO").

Independent claim 1 is amended herewith to specify that the "signal light [operates] as pump light in the four-wave mixing by two lights between the signal light and the continuous wave." The claim amendment is supported by the originally filed specification, for example, page 4 lines 16-22. An advantage of the claimed device is that the optical clock is regenerated independent from a bit rate.

The Office Action relies on Bigo to teach that the nonlinear optical medium may be embodied by a variety of modulators (see page 1215, left col., at the end of the 1st paragraph in Bigo). However, none of the modulators suggested in Bigo, generates an amplitude-modulated continuous wave, which is different from a phase conjugate light based on four-wave mixing by two lights between a signal light and the light continuous wave. According to amended claim 1

the non-linear optical medium "generates amplitude modulated CW light having said wavelength λ_c and including a component of said frequency f_s by performing amplitude modulation of said continuous wave based on four-wave mixing by two lights between the signal light and the continuous wave generated by the laser oscillation." Bigo does not disclose or render obvious a nonlinear optical medium or modulator performing as recited in claim 1.

Further, Bigo does not anticipate or render obvious that the "signal light [operates] as pump light in the four-wave mixing by two lights between the signal light and the continuous wave" as recited in amended claim 1. Thus, the above-reproduced features recited in amended claim 1 are not anticipated or rendered obvious by any of the modulators listed in Bigo.

Ramaswami discloses that, "[the] most common means of achieving mode lock is by modulating the gain of laser cavity. Either amplitude or frequency modulation can be used." (See page 141, 4th paragraph of Ramaswami. However, Ramaswami does not disclose generating any amplitude modulated continuous wave in the laser cavity. Further, Ramaswami fails to disclose generating an amplitude-modulated continuous wave based on four wave mixing by two lights between a signal light and the light continuous wave. Accordingly, Ramaswami does not compensate for the above-identified failure of Bigo in anticipating or rendering obvious the above-identified features recited in amended claim 1 and related to the non-linear optical medium.

In col. 6 lines 52-58, Smith states "Irrespective of the particular components or configuration chosen, the method utilises the incoming data stream to drive or 'pump' a mode-locked laser, which in turn generates short, picosecond duration pulse trains at the base rate (or an exact multiple) of the data. The data serves to modulate either the amplitude or phase of the light in the laser cavity." However, Smith fails to disclose generating an amplitude-modulated continuous wave in the laser cavity. Accordingly, Smith does not correct or compensate for the above-identified failure of Bigo and Ramaswami in anticipating or rendering obvious the above-identified features recited in amended claim 1 and related to the non-linear optical medium.

In col. 8, lines 6-12 Watanabe states "Where, for example, a laser diode is employed for the pump light 2, an information signal is superimposed on the drive current for the laser diode to perform amplitude modulation or intensity modulation of pump light to modulate the gain of the non-linear optical medium 1, and as a result, modulated output signal light and phase conjugate light can be obtained." However, the pump light is amplitude modulated or intensity modulated based on the information signal, but is not a signal light input to the signal light input port 3 in FIG. 4 of Watanabe. Watanabe does not teach or suggest that the signal light at the input port 3

is a continuous wave. Thus, Watanabe's col. 8, lines 6-12 do not anticipate or render obvious "generates amplitude modulated CW light having said wavelength λ_c and including a component of said frequency f_s by performing amplitude modulation of said continuous wave based on four-wave mixing by two lights between the signal light and the continuous wave generated by the laser oscillation" as recited in amended claim 1.

Further Watanabe discloses modulating signal light at the signal light input port 3 based on pump light which is amplitude modulated or intensity modulated based on information signal, but fails to disclose using the signal light of the signal light input port 3 as a pump light, in the four-wave mixing in a non-linear optical medium 1. Thus, Watanabe's col. 8, lines 6-12 do not disclose or render obvious "said signal light operating as pump light in the four-wave mixing by two lights between the signal light and the continuous wave" as recited in amended claim 1.

In col. 9, lines 39-44, Watanabe states "Where the modulation means 51 modulates the intensity or the amplitude of pump light, the gain of the non-linear optical medium 1 is varied in response to such modulation, and accordingly, modulation can be performed for both of the signal light to be outputted from the signal light output port 5 and the phase conjugate light to be outputted from the phase conjugate light output port 6."

However, the pump light is amplitude modulated or intensity modulated based on the information signal, but is not a signal light input to the signal light input port 3 in FIG. 4. Further, Watanabe discloses generating modulated output signal light and phase conjugate, but fails to disclose generating amplitude modulated output signal in col. 9, lines 39-44. Still further, Watanabe fails to disclose or render obvious that signal light at the signal light input port 3 is a continuous wave in col. 9, lines 39-44. Accordingly, Watanabe's col. 9, lines 39-44 fails to disclose generating an amplitude modulated continuous wave based on four-wave mixing by two fights between signal light and the light continuous wave in col. 9, lines 39-44.

Watanabe discloses modulating signal light at the signal light input port 3 based on pump light which is amplitude modulated or intensity modulated based on information signal, but fails to discloses using signal light at the signal fight input port 3 is the four-wave mixing in a non-linear optical medium 1 as pump light in col. 9, lines 39-44.

Related to FIG. 30 therein, Watanabe discloses that the modulation occurs due to the interaction of all-optical signals in the non-linear optical medium of 303. However, the pump fight in Fig. 30 is modulated based on the information signal, but is not a signal light transmitted through a fiber. Further while discussing FIG. 30, Watanabe does not disclose or render obvious that input signal light (probe light) is a continuous wave. Accordingly, FIG. 30 of Watanabe does

not disclose or render obvious generating an amplitude modulated continuous wave based on four-wave mixing by two lights between a signal light and the light continuous wave.

Further, Watanabe discloses modulating signal light at the signal light input port 3 based on pump light which is amplitude modulated or intensity modulated based on an information signal, but fails to discloses using signal light input to the signal light input port 3 as a pump light in the four-wave mixing in a nonlinear medium 1 when discussing FIG. 30.

Thus, FIG. 30 of Watanabe does not disclose or render obvious a nonlinear optical medium or modulator performing as recited in claim 1.

Therefore, Watanabe does not correct or compensate for the above-identified failure of Bigo, Ramaswami and Smith in anticipating or rendering obvious the above-identified features recited in amended claim 1 and related to the non-linear optical medium.

In view of the above, Applicants respectfully submit that the cited prior art references do not render obvious claim 1 as amended. Therefore, amended independent claim 1 and claims 3, 6-9, 12, 18-21 and 25 depending directly or indirectly from claim 1, patentably distinguish over the cited prior art.

Independent claims 14, 15, and 17 are amended herewith in a manner similar to amended claim 1.

In view of the above discussion, amended claim 14 and claims 22 and 26 depending directly or indirectly from claim 14, patentably distinguish over the cited prior art at least because the prior art does not anticipate or render obvious the following recitations of amended claim 14:

> said nonlinear optical medium includes a second optical fiber to which said signal light of said input port is inputted from said optical loop, and said continuous wave having said wavelength λ_c is input from said optical loop, and generates amplitude modulated CW light having said wavelength λ_c and including a component of said frequency f_s by performing amplitude modulation of said continuous wave based on four-wave mixing by two lights between the signal light and the continuous wave generated by the laser oscillation, said signal light operating as pump light in the four-wave mixing by two lights between the signal light and the continuous wave.

Amended independent claim 15 and claims 16, 23 and 27 depending directly or indirectly from claim 15, patentably distinguish over the cited prior art at least because the prior art does not anticipate or render obvious the following recitations of amended claim 15:

> said nonlinear optical medium includes a second optical fiber to which said signal light of said input port is inputted from said

> optical loop, and said continuous wave having said wavelength λ_c is inputted from said optical loop, and generates amplitude modulated CW light having said wavelength λ_c and including a component of said frequency f_s by performing amplitude modulation of said continuous wave based on four-wave mixing by two lights between the signal light and the continuous wave generated by the laser oscillation, said signal light operating as pump light in the four-wave mixing by two lights between the signal light and the continuous wave.

Amended independent claim 17 and claims 24 and 28 depending directly or indirectly from claim 17, patentably distinguish over the cited prior art at least because the prior art does not anticipate or render obvious the following recitations of amended claim 17:

> wherein said step (d) generates amplitude modulated CW light having said wavelength λ_c and including a component of said frequency f_s by performing amplitude modulation of said continuous was based on four wave mixing by two lights between the signal light and the continuous wave generated by the laser oscillation, said signal light operating as pump light in the four-wave mixing by two lights between the signal light and the continuous wave

The other cited references, Watanabe 9/97 and Watanabe WO, do not correct or compensate for the above-identified failure of the cited references to anticipate or render obvious all the features recited in the independent claims.

NEW CLAIMS

New claims 29-32 depending from claims 1, 14, 15 and 17, respectively, specify that "said signal light of said input port is frequency-modulated or phase modulated at a frequency sufficiently lower than a bit rate of the signal light, to suppress a stimulated Brillouin scattering (SBS) due to signal light power." The claim amendments are supported by the originally filed specification, for example, on page 18, lines 17-22. No new matter is added. Applicants found no evidence that any of the cited references disclose or render obvious the new feture recited in claims 29-32. Therefore, claims 29-32 are patentable by inheriting patentable features from the independent claims and by reciting a new patentably distinguishing feature.

CONCLUSION

There being no further outstanding objections or rejections, it is submitted that the application is in condition for allowance. An early action to that effect is courteously solicited.

Finally, if there are any formal matters remaining after this response, the Examiner is requested to telephone the undersigned to attend to these matters.

If there are any additional fees associated with filing of this Amendment, please charge the same to our Deposit Account No. 19-3935.

Respectfully submitted,

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